

University of Massachusetts Medical School

eScholarship@UMMS

UMass Center for Clinical and Translational
Science Research Retreat

2016 UMass Center for Clinical and
Translational Science Research Retreat

May 20th, 12:30 PM

Optimization of the Design of an Amphiphilic Biodegradable Polymer for Tissue-engineering Application

Ben Zhang

University of Massachusetts Medical School

Et al.

Let us know how access to this document benefits you.

Follow this and additional works at: https://escholarship.umassmed.edu/cts_retreat



Part of the [Biomaterials Commons](#), [Molecular, Cellular, and Tissue Engineering Commons](#), and the [Translational Medical Research Commons](#)

Zhang B, Filion TM, Song J. (2016). Optimization of the Design of an Amphiphilic Biodegradable Polymer for Tissue-engineering Application. UMass Center for Clinical and Translational Science Research Retreat. Retrieved from https://escholarship.umassmed.edu/cts_retreat/2016/posters/98

Creative Commons License



This work is licensed under a [Creative Commons Attribution-Noncommercial-Share Alike 3.0 License](#).

This material is brought to you by eScholarship@UMMS. It has been accepted for inclusion in UMass Center for Clinical and Translational Science Research Retreat by an authorized administrator of eScholarship@UMMS. For more information, please contact Lisa.Palmer@umassmed.edu.

Optimization of the Design of an Amphiphilic Biodegradable Polymer for Tissue-engineering Application

Ben Zhang, PhD, Tera Fillion, PhD, Jie Song, PhD

Department of Orthopedics & Physical Rehabilitation, University of Massachusetts Medical School,
Worcester, MA 01655, USA

ABSTRACT:

Biodegradable polymers have been widely utilized as drug delivery vehicles and tissue engineering scaffolds. We previously designed amphiphilic triblock copolymer poly(lactic acid)-*b*-poly(ethylene glycol)-*b*-poly(lactic acid) (PELA) and its hydroxyapatite (HA) composites for bone tissue engineering applications. The hydrophilic electrospun PELA-HA composite exhibited aqueous stability and elastic handling characteristics, and was able to template the proliferation and osteogenesis of bone marrow stromal cells (BMSCs) *in vitro* and *in vivo* when spiral-wrapped into cylinders and press-fit into critical size femoral segmental defects in rats. However, the slow degradation of PELA has prevented timely disappearance of the scaffold and impeded more effective restoration of biomechanical integrity of the defect. To accelerate degradation, in this work we designed poly(lactic/glycolic acid)-*b*-poly(ethylene glycol)-*b*-poly(lactic/glycolic acid) (PELGA) with varying ratios of glycolide and lactide and confirmed their more accelerated degradations as compared to PELA. Processing conditions (e.g. solvent-casting vs. electrospinning, with or without hydration) significantly impacted the structural characteristics of PELGA and their HA composites. The PEG crystallization in PELGA was not as strong as in PEG homopolymers, giving rise to a lower T_m . HA could be well dispersed in PELGA and electrospun to give a uniform composite where the crystallization of PEG was promoted by water resulting in enhanced mechanical strength upon hydration. These HA-contained electrospun meshes exhibited excellent cytocompatibility and efficacy in templating osteogenesis of rat BMSCs *in vitro*.

Contact:

Ben Zhang

Ben.zhang@umassmed.edu